HOLLOW SECTION WITH INTERNAL REINFORCEMENT AND METHOD OF PRODUCING THE HOLLOW SECTION

Cross-Reference to Related Application:

This is a continuation of copending International Application PCT/DE99/00700, filed March 15, 1999, which designated the United States.

Background of the Invention:

Field of the Invention:

The invention relates to a hollow section with internal reinforcement, especially for use in car bodies, as well as a method of producing the hollow section.

In mechanical engineering, and also especially in car manufacture, punched and preshaped plate sections are welded together to form a double shell. Adequate resistance torques and bending strengths of the hollow sections thus resulting can be achieved only if the plate cross sections are enlarged accordingly or the plate wall thickness is increased. An enlargement of the cross sections results, especially in motor vehicles, in a change in the internal or external dimensions, and an increase in the wall thickness results in an undesirable additional weight. Another possibility for

reinforcing hollow sections is to strengthen them with ribbed sections. In the case of hollow sections which are to be given an internal corrosion protection, ribbed sections are, however, unsuitable if a desired protective layer, as is customary with car bodies, is produced by the dipping method, because the ribbed sections prevent the corrosion protection agent from reaching all parts of the internal sections or form undesirable pockets.

German published patent application DE 42 27 393 A1 purports to have achieved a reduction in the corrosion susceptibility of the metal of the hollow body in the region of the space enclosed thereby. To this end, inter alia, an electrically conductive layer made from a sacrificial metal or from a foil is inserted, this layer being caused to lie against the inner surface of the hollow body by foaming a material encasing the core. This publication provides no indication of how an internal reinforcement suitable for absorbing forces can be achieved in the case of hollow sections.

The foam-filling of hollow parts to improve mechanical resistance to deformation is known from German published patent application DE 196 35 734 A1. The hollow parts concerned are primarily seamless or welded pipes, which can be reshaped if desired. No special measures for reducing susceptibility to corrosion are indicated.

Summary of the Invention:

The object of the invention is to provide a hollow section and a corresponding production method which overcomes the above-noted deficiencies and disadvantages of the prior art devices and methods of this kind, and wherein a corrosion protection medium can reach all areas of the hollow section and a high degree of rigidity can be achieved without a substantial increase in weight or enlargement of the cross section.

With the above and other objects in view there is provided, in accordance with the invention, a method of producing a hollow section with internal reinforcement, which comprises:

coating a solid core material with activatable material;

enclosing the solid core material and the activatable material with an outer plate to form an assembly with a defined cavity inside the outer plate;

passing the assembly to a corrosion treatment bath and subjecting all interior areas of the assembly to a corrosion protection agent; and

subsequently passing the assembly to a drying oven for initiating foaming of the activatable material and filling the cavity defined cavity with the activatable material.

In other words, the objects of the invention are satisfied with a hollow section having internal reinforcement, especially for use in car bodies, in which a core material is coated with activatable material and an outer plate is disposed to form a cavity, the size of the cavity being such that it can be completely filled by the operation of foaming the activatable material, and the solid core material being formed from a foamed or unfoamed metallic material or from a synthetic material reinforced with metal fibers, carbon fibers or glass fibers. The possibility exists of forming the solid core material with a flexurally rigid hollow section. Advantageously, the solid core material is coated with the activatable material only in some areas.

According to the invention, the core material and the outer material used for coating are formed from a reinforcing and/or an energy-absorbing foam system and/or an acoustic foam. In an embodiment of the invention, the core material is formed from an energy-absorbing material and the outer material used for coating is formed from a reinforcing material and/or an acoustic foam. In an alternative embodiment of the invention, the core material is formed from a reinforcing material and the outer material used for coating is formed from an energy-absorbing material and/or an acoustic foam. The possibility exists of forming the core material from an acoustic foam and

the outer material used for coating from a reinforcing and/or energy-absorbing material.

A method according to the invention is wherein the hollow section, before the operation of foaming the activatable material, is passed to a corrosion protection dipping bath and the corrosion protection agent reaches all areas of the inner section and the hollow section is then passed to a drying oven.

With the above and other objects in view there is also provided, in accordance with the invention, a hollow section, comprising:

a solid core material formed of a material selected from the group consisting of foamed metallic material, unfoamed metallic material, synthetic material reinforced with fibers selected from the group consisting of metal fibers, carbon fibers, and glass fibers, and a hollow section;

activated, foamed material on the solid core material;

an outer plate enclosing the solid core material, with the foamed material at least partly filling a defined cavity between the solid core material and the outer plate;

the solid cover material, the foamed material, and the outer plate being corrosion treated with a corrosion protection agent and subsequent drying.

In accordance with a concomitant feature of the invention, temperature for the coating of the solid core material provided with the activatable material is kept lower than the stoving temperature for the anticorrosion layer in the drying oven. In a further embodiment of the invention, a reaction of the activatable material is deliberately initiated in the drying oven as a result of the higher temperature and the cavity originally deliberately formed between the activatable material and the outer plate is filled by the foam which forms.

Other features which are considered as characteristic for the invention are set forth in the appended claims.

Although the invention is illustrated and described herein as embodied in a hollow section with internal reinforcement and method for producing this hollow section, it is nevertheless not intended to be limited to the details shown, since various modifications and structural changes may be made therein without departing from the spirit of the invention and within the scope and range of equivalents of the claims.

The construction and method of operation of the invention, however, together with additional objects and advantages thereof will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

Brief Description of the Drawings:

Fig. 1 is a diagrammatic sectional view of a hollow section before foam-filling;

Fig. 2 is a similar view of the structure after foam-filling;

Fig. 3 is a diagrammatic section view of the structure similar to that of Fig. 1, but here with a solid core material in the form of a solid shaped body with a cavity; and

Fig. 4A to 4D are various sectional and partly perspective views of various alternative embodiments of sections coated with foamable material.

Description of the Preferred Embodiments:

Referring now to the figures of the drawing in detail and first, particularly, to Fig. 1 thereof, there is seen a solid core material 1 coated with an activatable material 2. An outer plate 4 is disposed to form a cavity 3. The cavity 3 is completely filled by the operation of foaming the activatable

material 2. The size of the cavity 3 is predetermined in accordance with the particular application. For this purpose, spacers 5 are used and, according to Figure 1, are disposed on the inside of the outer plate 4. According to Figure 3, the solid core material 1 is formed by a flexurally rigid hollow section 6.

Before the foaming operation, the hollow section 6 is passed to a corrosion protection dipping bath. Because the inside of the outer plate 4 is still freely accessible in this condition, the corrosion protection agent can reach all areas of the inner section. The coating of the core material 1 takes place at a temperature which is lower than the stoving temperature for the anticorrosion layer applied in the drying oven. This higher temperature in the drying oven results in a reaction of the coating material, as a result of which the foaming operation is initiated and the cavity 3 which has been deliberately formed is filled with foam.